Santa Clara Valley Water District

SOUTH COUNTY WATER SUPPLY PLANNING PROJECT

PROJECT REPORT

July 2010

Contents

Executive Summary 1
1. Introduction 3
    1.1 Background 3
    1.2 Project Objectives 3
    1.3 Project Approach 4
2. Planning Objectives 7
    2.1 Objectives 7
    2.2 Sub-Objectives and Predictive Indicators 8
    2.3 Other Considerations 9
3. Baseline Water Supply Outlook 11
    3.1 Projected Groundwater Demands 11
    3.2 Water Supply Availability Analysis 12
    3.3 Baseline Water Supply Shortfall Analysis 13
    3.4 Other Baseline Analysis Findings 14
    3.5 Baseline Water Supply Outlook Summary 15
4. Water Supply Alternatives 17
    4.1 Initial Evaluation of Water Supply Options 17
    4.2 Benefit and Cost Analysis 19
5. Portfolio Construction and Evaluation 21
    5.1 Updated Water Supply Shortfall Estimate 21
    5.2 Initial Portfolio Development 21
    5.3 Initial Portfolio Evaluation 21
    5.4 Portfolio Evaluation with Modeling 24
    5.5 Portfolio Analysis Summary 27
6. Findings and Recommendations 29
    6.1 Key Findings 29
    6.2 Recommendations 31

Figures

Figure 2 - 1: Planning Objectives 10
Figure 3 - 1: Historic Groundwater Production and Rainfall 11
Figure 5 - 1: Initial Portfolio Scores 24

Tables

Table 3 - 1: Net Projected Groundwater Demands (AFY) in the Llagas Groundwater Subbasin 12
Table 4 - 1: Initial Water Supply Options 17
Table 4 - 2: Summary of Water Supply Option Benefits and Costs 20
Table 5 - 1: Initial Portfolios 22
Table 5 - 2: Groundwater Modeling Results Summary 26

Appendices

Appendix A: Llagas Groundwater Subbasin Water Supply Facilities
Appendix B: Water Supply Alternatives
Appendix C: Groundwater Hydrographs of Final Portfolio Analysis

ACKNOWLEDGEMENTS

District staff greatly appreciates the following individuals, and the agencies they represent, for their participation in the project:

Mario Iglesias, City of Morgan Hill
Steve Ross, County of Santa Clara
Rick Smelser, City of Gilroy

They brought insight, advice, expertise, and enthusiasm to the project and the value of their contributions cannot be overstated.

The District's project manager also acknowledges the following District staff, without whom this project would not have been completed:

Chanie Abuye
Behzad Ahmadi
Kent Haake
Mark Merritt
Jeff Micko
Judy Nam
Miguel Silva
Stanley Zhu

This report was prepared by District Senior Project Manager Tracy Hemmeter.

Executive Summary

The South County Water Supply Planning project was a collaborative effort between staff from the Santa Clara Valley Water District (District), City of Gilroy, City of Morgan Hill, and County of Santa Clara (County). Staff from these organizations comprised the Planning Team. Project work included determining planning objectives, projecting future water demands, documenting existing and anticipated water supplies, analyzing projected future water supply shortfalls, identifying and quantifying potential new water supply options and management alternatives for meeting shortfalls, and evaluating water supply portfolios.

It is anticipated that groundwater demands in the Llagas Groundwater Subbasin will increase by about 7,000 acre-feet per year (AFY) by 2030. More than 4,000 AFY of additional water supplies will be needed to meet groundwater management objectives and provide a reliable water supply in the future. The Planning Team's recommendations for additional water supplies are:

- repair or replace Madrone Pipeline,
- implement a lower groundwater elevation target for the Llagas Groundwater Subbasin,
- better document operations plans and the balance between imported water deliveries to North County drinking water treatment plants and South County recharge facilities,
- continue to explore and, as appropriate, develop recycled water options
- consider the City of Morgan Hill Butterfield Channel in the Master Plan
- focus on groundwater recharge and recycling in future water supply planning efforts, and
- continue groundwater quality protection efforts.

The original purpose of the project was to develop a long-term water supply plan for the Llagas Groundwater Subbasin area in southern Santa Clara County. About the time the Planning Team was developing their recommended water supply plan for the Llagas Subbasin, the District embarked on a countywide Water Supply and Infrastructure Master Plan (Master Plan). The South County planning work will be completed as part of the Master Plan, which is scheduled for completion in August 2012.

1. Introduction

The District initiated the South County Water Supply Planning project in July 2005. The purpose of the project was to develop a long-term water supply plan for the Llagas Groundwater Subbasin area. The Llagas Subbasin sits between the Santa Cruz Mountains on west and Diablo Range on the east, and extends from about Cochrane Road in Morgan Hill south to the county boundary at the Pajaro River. The project was a collaborative planning effort between the District, Cities of Morgan Hill and Gilroy, and the County. The planning effort evaluated existing and potential infrastructure and operations for ensuring water supplies are reliable to meet future demands in the Llagas Groundwater Subbasin. This report documents the work that was completed as part of the project and makes recommendations for future work.

1.1 Background

The predominant source of water supply in the Llagas Subbasin is groundwater, with surface and recycled water deliveries making up the balance. Groundwater is the sole source of drinking water. Current water demand in the subbasin is approximately 50,000 acre-feet per year, with about half the demand being for agricultural irrigation. Both natural recharge and controlled recharge using both local and imported surface water are necessary to meet demands and maintain groundwater levels. Several previous water supply planning efforts have addressed water supply reliability in the Llagas Groundwater Subbasin, including:

- Preliminary South County Water Resources Planning Study (Santa Clara County Flood Control and Water District, 1971)
- Master Plan for the Expansion of In-County Water Distribution System (Santa Clara Valley Water District, 1975)
- South Santa Clara County Water Supply Plan (Santa Clara Valley Water District, 1983)
- Integrated Water Resources Planning Study 2003 (Santa Clara Valley Water District, 2005)

All the planning efforts indicated some shortfalls between existing water supplies and anticipated future water demands. In addition, all the planning efforts recommended continuing to use the groundwater basin as the predominant water supply, adding additional groundwater recharge as necessary to meet growing demands. Some of the previous planning efforts recommended surface water treatment, if increased groundwater recharge or recycled water use was insufficient to meet water needs.

1.2 Project Objectives

The District initiated the South County Water Supply Planning project for a number of reasons. The District was seeking to improve its understanding of its South County customer and partner needs and expectations related to water supply reliability and financing. In addition, as noted above, previous analyses identified water supply shortfalls between existing supplies and future demands in the Llagas Groundwater Subbasin. However, the previous analyses were based

on old data, knowledge, and conditions and warrant a review to determine if their conclusions are still valid. Also, the most recent analysis performed as part of the Integrated Water Resources Planning Study 2003 (IWRP) was based on countywide analyses. Water supply alternatives specific to the Llagas Groundwater Subbasin were not developed in IWRP and the District's modeling ability at the time of the study was insufficient to capture details pertinent to South County water supply. Lastly, IWRP recommended evaluating potential water resource impacts from development in South County.

The primary objectives of the South County Water Supply Planning project were to evaluate water supply options for the Llagas Groundwater Subbasin and produce a Master Plan for implementing the recommended options for ensuring the water supply is reliable to meet future demands. Other objectives were:

- to implement the IWRP recommendation to evaluate potential water resource impacts from development in South County,
- to identify new infrastructure and potential land acquisition necessary to meet future water supply needs,
- to improve communication and coordination on land use and water supply planning,
- to evaluate whether additional groundwater quality management activities are necessary,
- to identify opportunities to optimize existing systems such as recharge facilities,
- to evaluate smaller, i.e., package plant, surface water treatment options,
- to ensure consistency with land use plans, and
- to manage costs and rates through alternative funding sources, such as developer fees.

1.3 Project Approach

The South County Water Supply Planning project was designed to define the programs and projects that are necessary to provide a reliable water supply in the Llagas Groundwater Subbasin under 2030 conditions, and options for how those programs and projects can be financed. As mentioned above, the project was a collaborative effort between the District, Morgan Hill, Gilroy, and the County. District staff performed the technical work, which was then reviewed and evaluated by the Planning Team. The Planning Team consisted of staff from the four agencies. The Executive Committee, consisting of executive management from the agencies, provided direction and oversight to the Planning Team. The Planning Team's findings and recommendations were presented to elected officials at a joint District/South County Regional Wastewater Authority Board (SCRWA) meeting in May 2009. The SCRWA Board is comprised of elected officials from Morgan Hill and Gilroy.

The Planning Team completed most of the original scope of work, including determining planning objectives, projecting future water demands, documenting existing and anticipated water supplies, analyzing projected future water supply shortfalls, identifying and quantifying potential new water supply options and management alternatives for meeting shortfalls, and

evaluating water supply portfolios. That work is documented in subsequent sections of this report, along with the project's findings and recommendations.

About the same time the Planning Team was developing their recommended water supply portfolio, the District embarked on a countywide Water Supply and Infrastructure Master Plan (WSIMP) project. The WSIMP will achieve the same objectives as the South County Water Supply Plan, but for all the areas of the County. Also, the WSIMP process will address how to manage water resources shared by the Llagas Subbasin and the rest of the county, such as the San Felipe Division and Anderson Reservoir, to meet the needs of the all areas of the County. Consequently, the District determined that it would be appropriate to complete the South County planning work as part of the countywide WSIMP. The additional South County master planning work that needs to be included in the WSIMP process includes analysis of water supply alternatives in a countywide context, environmental analysis, and developing schedule and financial plan for implementing the master plan. The WSIMP effort is scheduled to be completed in 2012.

2. Planning Objectives

Identifying planning objectives is a critical step in planning. The planning objectives reflect consensus on the collaborating agencies' priorities and allow evaluation and comparison of alternative projects and programs. Objectives also to minimize picking "pet" projects and discussing the objectives relative importance helps agencies understand each agency's issues and values. It is important to note that the planning objectives are developed to compare water supply alternatives and are distinct from the project objectives discussed in Section 1.2 Project Objectives.

The Planning Team used the District's IWRP planning objectives as a starting point for developing project-specific objectives. The IWRP objectives reflect the District's mission and Board's Ends policies on water supply, water quality, flood protection, and stream stewardship. Therefore, they provided a good starting point for District water supply planning processes. However, because IWRP was a countywide effort, it was worthwhile to review the planning objectives as they applied to the South County Water Supply Planning effort. In addition, the South County Water Supply Planning effort was a collaborative effort between the District, Cities of Gilroy and Morgan Hill, and County of Santa Clara, so it was important to make sure the planning objectives were consistent with those agencies' policies as well as the District policies. The Planning Team reviewed the IWRP planning objectives and recommended several revisions. The Executive Committee reviewed the Planning Team's recommendations and made further revisions.

2.1 Objectives

The four South County Water Supply Planning objectives developed by the Planning Team and revised by the Executive Committee are below, with their relative weights in parentheses.

1. **Ensure Supply and Reliability (60%)**

   This objective is to meet water demands throughout the Llagas Subbasin under all hydrologic conditions. To meet this objective, the District manages the groundwater basins, in conjunction with a variety of water supply sources and infrastructure, to provide water supply reliability. A variety of water supply sources and infrastructure provides redundancy and reduces the exposure to the risk of any one part of the system failing.

2. **Ensure Water Quality (20%)**

   Water quality is inextricably linked to water supply reliability. Given increasing information on the public health impacts of constituents often found in water, water quality has become an important driver in evaluating potential new investments. It is important to protect groundwater from contamination and to meet or exceed water quality regulations.

3. **Minimize Cost Impacts (15%)**

   Costs are also an important driver for evaluating potential new investments. District costs are reflected in groundwater production charges, but there may be additional costs or benefits to the community. For example, increased recycled water use can result in reduced wastewater management costs since there is less effluent requiring disposal. Another consideration in costs is the risk of stranding investments if conditions change in the future.

4. **Provide Community and Environmental Benefits (5%)**

   This objective captures benefits not captured in other objectives, including enhancing benefits to habitat and the local environment, protecting water quality for local habitat, maximizing the efficient use of existing resources, flood protection, and recreation.

2.2 Sub-Objectives and Predictive Indicators

Sub-objectives help define and capture the most important aspects of the primary objectives. Predictive indicators are measures of performance that can be used to evaluate whether water supply alternatives and portfolios achieve the planning objectives. Predictive indicators can be quantitative, based on values derived from real data or modeled calculations. They can also be qualitative, based on expert opinion or team consensus. The sub-objectives and predictive indicators are explained below, with their relative weights in parentheses. The planning objectives, sub-objectives, and predictive indicators are also show in Figure 2 - 1.

1. **Ensure Supply and Reliability**

   Two sub-objectives characterize supply and reliability:

   - **Provide for Subbasin Demands** (70%) — The predictive indicator for this sub-objective focused on the frequency and magnitude of unmet demands in the Llagas Groundwater Subbasin. The purpose of this study is to provide a reliable supply of water for the Llagas Groundwater Subbasin.

   - **Deliver Water if Part of the Groundwater System Fails/Redundancy** (30%) — The predictive indicator for this sub-objective is evaluated based on the variety of

sources, delivery systems, and storage. This sub-objective reflects not only the variety of water supply sources, but also the ability to move water around the subbasin and deliver it where it is needed.

2. **Ensure Water Quality**

   Two sub-objectives characterize water quality:

   - **Protect Groundwater Quality** (60%) — Groundwater is and continues to be an important water supply source in this county. The groundwater subbasins serve multiple functions, including storing, distributing, and treating water. Protecting the quality of this resource is critical to long-term water supply reliability. The predictive indicator for this sub-objective is the impact on groundwater quality, as measured by Total Dissolved Solids (TDS) concentrations.

   - **Meet or Exceed Water Quality Regulations** (40%) — This sub-objective has two predictive indicators – nitrate concentrations in delivered drinking water and bromide concentrations in imported water. Nitrate is the most common water quality regulatory compliance issue in the Llagas Subbasin. Bromide is an indicator of the ability to meet water quality regulations related to disinfection by-products, which is a key surface water treatment issue.

3. **Minimize Cost Impacts** (15%) — The predictive indicator for this objective is the total present value of the water supply portfolio.

4. **Ensure Community and Environmental Benefits** (5%) — The predictive indicator for this objective is the degree of benefits to environmental habitat, flood protection, recreation, and water use efficiency.

2.3 Other Considerations

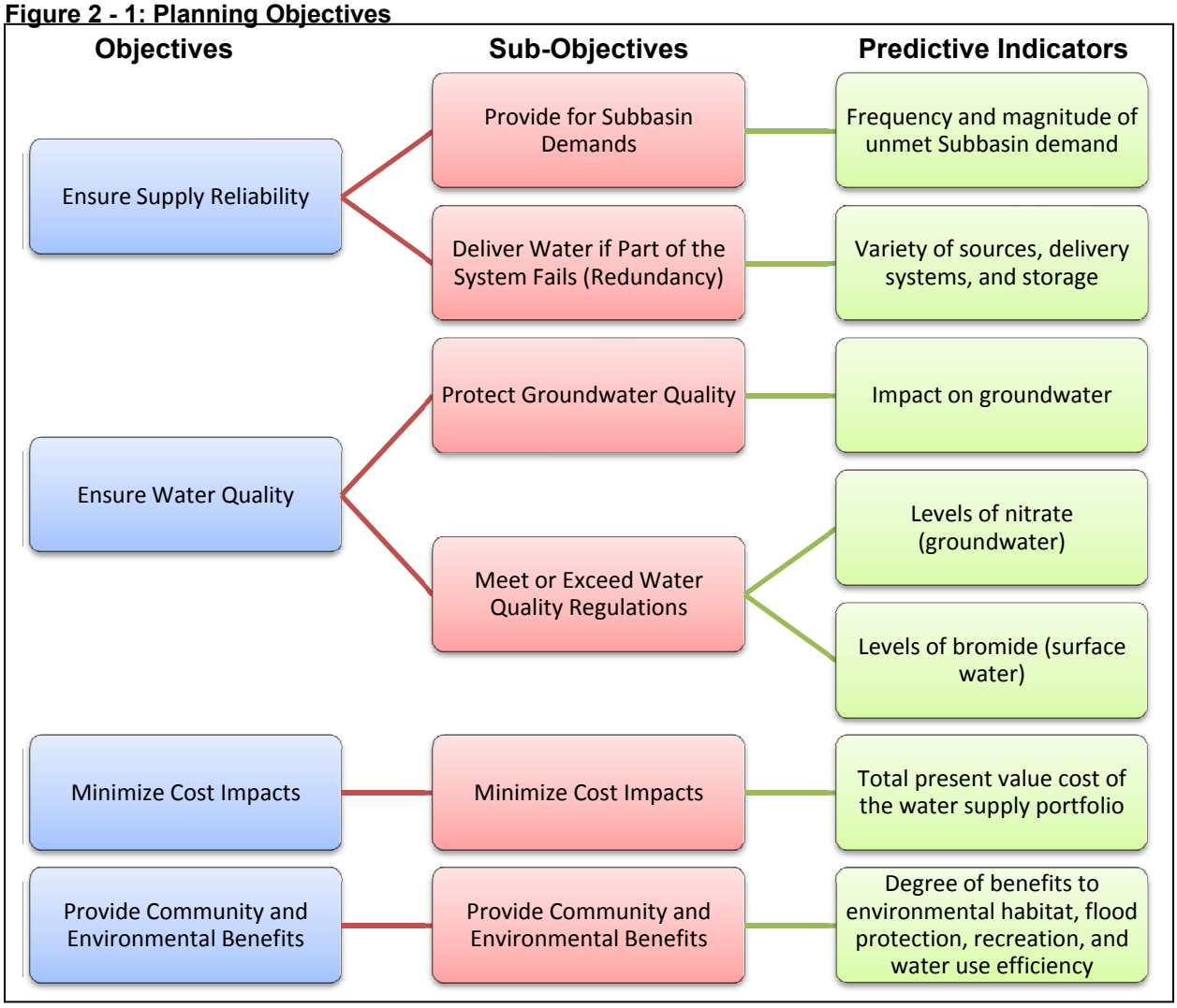
The Planning Team had originally proposed a total of 14 sub-objectives. The Executive Team believed using 14 sub-objectives would be an unnecessary level of analysis for the study. They decided to use the objectives and sub-objectives in Figure 2 - 1, unless additional detailed analysis was necessary to distinguish between water supply alternatives.

Some of the other considerations that were discussed by the Planning Team and Executive Committee, but not captured in the objectives and sub-objectives listed above, include:

- Efforts to secure water supply reliability in South County should not adversely affect North County without appropriate mitigation
- There is an interest in ensuring an equitable distribution of supplies in the Llagas Groundwater Subbasin and avoiding stand-alone systems

- Cooperation and partnerships within the subbasin, as well as with agencies and organizations outside the subbasin, can contribute to water supply reliability. For instance, the Llagas Groundwater Subbasin is connected to the Bolsa Subbasin in San Benito County and groundwater management activities in each subbasin will affect the other
- The District's groundwater production charge and the stability of that charge are important indicators to the Cities
- Adaptability and scalability, which are related to avoiding stranded costs, are important cost considerations
- Perchlorate is an important water quality consideration

Figure 2 - 1: Planning Objectives



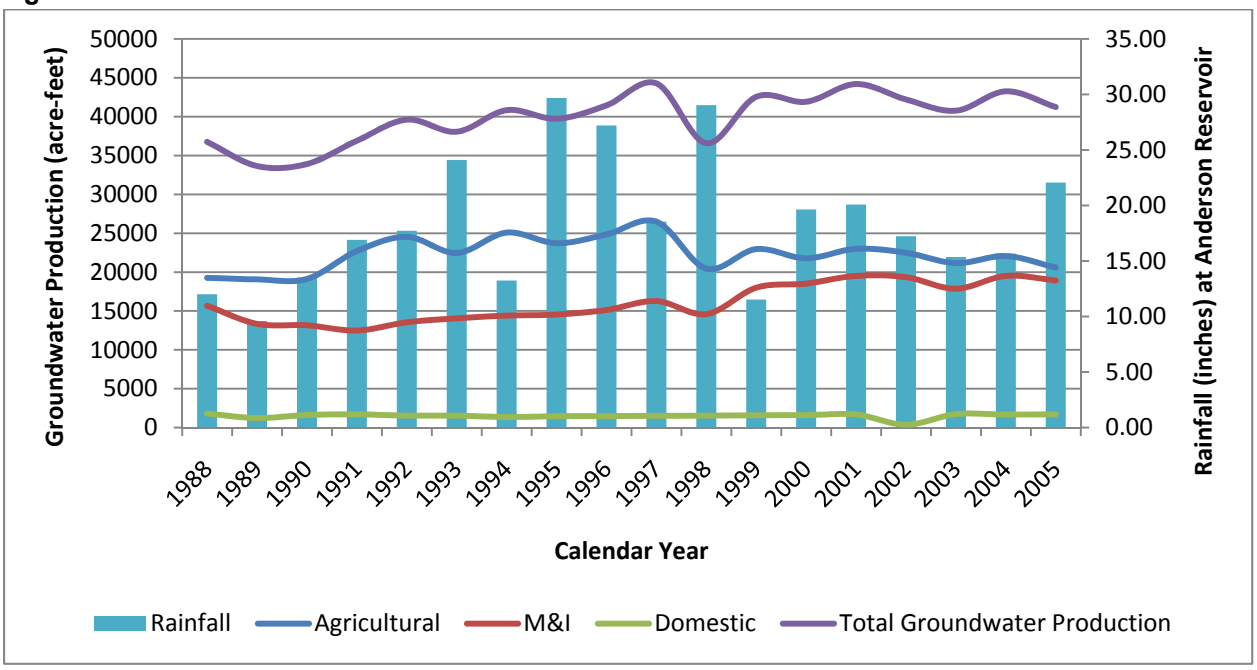
3. Baseline Water Supply Outlook

The baseline water supply outlook describes anticipated future water supply conditions and is used as a basis for developing water supply alternatives to fill anticipated shortfalls. The baseline outlook includes projected groundwater demands, an assessment of water supplies, and estimated water supply shortfalls under 2030 conditions. The shortfalls analysis was performed using the District's Llagas Groundwater Subbasin Groundwater Model.

3.1 Projected Groundwater Demands

Projected demands on the groundwater basin are necessary to perform groundwater modeling in support of developing the baseline water supply outlook. Thus, it was necessary to estimate groundwater production levels in 2030. District staff reviewed projected water demands from the District's 2005 Urban Water Management Plan (UWMP) and the Cities' Water System Master Plans as a starting point for developing the groundwater demand projection. District staff also reviewed historic groundwater production data, which is presented in Figure 3 -1.

Figure 3 - 1: Historic Groundwater Production and Rainfall



The projected 2030 groundwater production level is based on a number of assumptions, which include:

- Actual 2001 groundwater production is representative of current demands. This is based on reviewing groundwater production and rainfall records from 1988 to 2005 and considering production by sector (agriculture, M&I, and domestic) and during different hydrologic conditions.

- Agricultural water production will remain constant over the planning horizon. This is based on groundwater production data, consulting with land use agencies regarding agricultural land use, UWMP projections, and input provided by the District's Agricultural Water Advisory Committee.
- Non-agricultural water production in unincorporated areas will remain constant over the planning horizon. This is based on groundwater production data and consulting with County Planning on land use.
- Groundwater production in Gilroy and Morgan Hill will increase over the planning horizon, based on projections from the cities' and District UWMPs and cities' water master plans. New groundwater production was assigned to new wells the cities plan to install over the planning horizon.
- Conservation will be achieved in municipal and industrial (M&I) wells. This is consistent with the District's UWMP, which assumes the District will implement the "No Regrets" conservation recommendation from IWRP 2003. This level of conservation will achieve about a 13 percent decrease in per capita water demands from the baseline year of 2000 to 2030.
- Recycled water use in the Gilroy area, which offsets groundwater production, will increase based on implementing the Immediate- and Short-Term Capital Improvement Programs (CIPs) in the South County Recycled Water Master Plan.
- Groundwater production will not be adjusted based on rainfall. Staff was unable to correlate variations in annual groundwater production with variations in annual rainfall. District staff suspects that it is the timing of rainfall that is the determining factor in groundwater production. Rainfall in late spring or early fall will offset more groundwater demand than heavier rains in early winter when demands are low. This is especially true for agriculture, which accounts for about half the water use in the Llagas Subbasin.

The net 2030 groundwater demand, or groundwater production level, for the Llagas Groundwater Subbasin is projected to be 50,800 AFY. The breakdown of these demands and how they compare to current demands are presented in Table 3 - 1. The groundwater demand projections assume 4,100 AFY additional conservation over the 2000 (baseline year) level and 1,900 additional recycling over the 2001 level. The net increase over current groundwater demands is about 6,600 AFY.

Table 3 - 1: Net Projected Groundwater Demands (AFY) in the Llagas Groundwater Subbasin

Water Use	Projected 2030 Demands	Current (2001) Demands	Difference
Municipal and Industrial	26,100	19,500	6,600
Agricultural	23,000	23,000	0
Domestic	1,700	1,700	0
Total	**50,800**	**44,200**	**6,600**

3.2 Water Supply Availability Analysis

District staff used the Llagas Subbasin groundwater flow model to evaluate groundwater conditions under different pumping scenarios and estimate the shortfall between projected water

supplies and projected water demands. The first step is to identify the supplies that are anticipated to be available in the future. Staff made the following assumptions regarding water supply availability in 2030:

- The Madrone Avenue pipeline, which delivers water from the Santa Clara Conduit, will continue to be operational at the 2007 capacity.
- The Main Avenue pipeline, which previously delivered water from Anderson Reservoir to the Llagas Groundwater Subbasin, will remain out of service. Note: During the project, the Main Avenue Pipeline Restoration Project was added to the District's Capital Improvement Program. Later analyses assume operation of the Main Avenue pipeline.
- Imported water supplies for groundwater recharge in the Llagas Subbasin will continue to be available at their current level of reliability.
- The Church Avenue Diversion will be repaired or replaced.
- Conservative recharge facility capacities represent the most likely operating scenario.
- Imported water supply availability was estimated based on the CalSim modeling results as of September 2007.
- Water supplies were estimated for the years 1967 through 1996, a 30-year set of hydrology that encompasses a severe drought (1977) and an extended drought (1987-1992).
- Water supply operations in the lower Llagas Subbasin, which is the area of the subbasin south of Morgan Hill, will be based on the proposed operating strategy to replace the 1956 agreement with the California Department of Fish and Game for the operation of Uvas Reservoir and the Uvas-Llagas Transfer Pipeline. The operating strategy affects recharge operations on Uvas and Llagas Creeks, as well as recharge in the Church Avenue Ponds.
- Although Llagas Subbasin is hydraulically connected to Coyote and Bolsa Subbasins, for modeling purposes it is assumed that the development in the Coyote Subbasin or San Benito County would not impact groundwater conditions in the Llagas Groundwater Subbasin.

Water supply facilities in the Llagas Groundwater Subbasin are illustrated in Appendix A.

3.3 Baseline Water Supply Shortfall Analysis

Estimating the water supply shortfall is not as simple as calculating the difference between estimated demands and estimated average supplies. The District strives to maintain groundwater elevations above the management goal (Target Elevation) at all times. In dry years, when natural recharge decreases, groundwater levels will decline if artificial recharge is not increased sufficiently. In some years, the availability of supplies or recharge capacity may limit recharge and groundwater levels will decline. In addition, the Llagas Subbasin and Bolsa Subbasin in San Benito County are hydraulically connected and there are subbasin exchanges that occur throughout the year depending on groundwater conditions. Therefore, in order to estimate the 2030 water supply shortfall in the Llagas Groundwater Subbasin, District staff estimated the annual groundwater production level the subbasin could support while meeting

groundwater management goals of maintaining groundwater elevations and minimizing subbasin exchanges with the Bolsa Subbasin.

At the time the baseline shortfall analysis was conducted in September 2007, the groundwater elevation target for the Llagas Groundwater Subbasin was to maintain groundwater elevations above 1987 conditions, when the District began managing the Llagas Subbasin. Groundwater modeling results indicated that, under estimated 2030 demands, groundwater levels would decline below the target and below the completed depth for number of wells, resulting in "dry wells". Staff then reduced groundwater production to determine the annual pumping level that would keep groundwater elevations above the target at all times. Based on this analysis, annual groundwater production would need to decrease to 35,000 AFY to meet the groundwater elevation target. This equates to an estimated water supply shortfall of approximately 16,000 AFY under 2030 demands.

It needs to be noted that the shortfall estimate of 16,000 AFY is conservative. This is due to a number of factors, including:

- Maintaining groundwater elevations above the 1987 target at all times is conservative. Historically, we have seen groundwater levels drop below this level.
- The groundwater modeling assumptions include a no-flow at the groundwater divide with Coyote Subbasin at about Cochrane Road. In reality, there is some flow into the subbasin along the groundwater divide that is not reflected in the model.
- The System Simulation Model (SYSMOD), which models the District's water system and is used to estimate future recharge, prioritizes water deliveries to treatment plants in the northern part of the county consistent with treated water contracts. This results in imported water deliveries for recharge in the Llagas Subbasin being severely curtailed in some years. In practice, the District is able to operate the water system in a manner that maintains imported water deliveries to the Llagas Subbasin and meets treated water contract requirements.

3.4 Other Baseline Analysis Findings

The 35,000 AFY level of pumping that is estimated to be necessary to meet groundwater management goals under 2030 groundwater production levels is less than the current production level of about 44,000 AFY. Staff performed additional modeling and analysis to better understand how the different assumptions affect the water supply outlook. The findings of that analysis indicated:

- Modeling assumptions on the priority of water deliveries significantly impact the water supply outlook. When deliveries to the Llagas Subbasin for recharge were prioritized higher than treated water deliveries in SYSMOD, the water supply shortfall decreased by about 5,000 AFY.
- Assuming that groundwater levels do not need to be maintained above the 1987 target 100 percent of the time impacts the water supply outlook. The modeling indicated that

- The water supply shortfall appears more pronounced in the northern part of the subbasin, around the Morgan Hill area. The northern part of the subbasin is smaller than the southern part of the subbasin, around Gilroy, its position at a groundwater flow divide limits inflow, and natural groundwater flow is toward Gilroy. This indicates the importance of conducting managed groundwater recharge to maintain groundwater levels.
- The location of pumping affects the water supply outlook. Staff simulated a scenario where Morgan Hill's new wells were relocated in the Gilroy area. Under this scenario, the historical groundwater levels could be maintained for groundwater production of up to 44,000 AFY, reducing the shortfall by about 9,000 AFY.
- A lower groundwater elevation target for the Llagas Groundwater Subbasin may be possible and acceptable to stakeholders. Preliminary groundwater modeling indicated that lower groundwater elevations in the Llagas Subbasin will not result in significant adverse impacts on groundwater conditions, i.e., it will not cause wells to go dry.
- The operational storage capacity of the Llagas Subbasin may be significantly less than previously estimated, especially in the Morgan Hill area. A lower operational storage capacity estimate changes how staff develops and evaluates different water supply options.

3.5 Baseline Water Supply Outlook Summary

The estimated water supply shortfall in the Llagas Groundwater Subbasin, based on anticipated water supplies and demands in 2030, is approximately 16,000 AFY. This a conservative estimate and is based on a number of significant assumptions. These significant assumptions can be summarized as: agricultural demands will remain constant, M&I demands will increase as projected, and groundwater recharge will occur as projected. It is important to note that climate change impacts have not been incorporated into the assumptions because it is unclear how those impacts will play out in the Llagas Subbasin. The estimate also assumes that recharge is significantly reduced in some years to meet treated water demands in the northern part of the county and that the District will strive to maintain groundwater elevations above 1987 levels. Less conservative assumptions regarding recharge and groundwater levels significantly reduces the shortfall estimate.

4. Water Supply Alternatives

The next step in the planning process was to develop water supply options for satisfying the projected water supply shortfall in the Llagas Groundwater Subbasin and analyze the effectiveness of those options in meeting the projected water supply shortfall. The Planning Team identified a list of potential water supply options for meeting the water supply shortfall. Some of the water supply alternatives were further analyzed for capacity, cost, and benefit.

4.1 Initial Evaluation of Water Supply Options

The Planning Team divided the initial list of water supply options into three categories – recommended actions for implementation, actions for further analysis, and other alternatives for future or countywide consideration. The options were reviewed by the Executive Committee in December 2007. Table 4 – 1 lists the options that were identified, the rationale for how they were categorized, and Executive Committee comments.

Table 4 - 1: Initial Water Supply Options

Water Supply Option	Rationale/Discussion
Recommended Actions for Implementation	
Repair/replace Main and Madrone Pipelines	Replacement or repair of these existing facilities increases system flexibility by allowing Anderson Reservoir deliveries to the Llagas Subbasin and increases the capacity for water deliveries to the Upper Llagas recharge system.
Reconsider the groundwater elevation target	Managing for a lower groundwater elevation target may not have significant adverse impacts and the avoided cost may be significant. The Executive Committee noted that the cost/benefit analysis needs to look at increased pumping costs associated with lower water levels.
Ensure minimum deliveries to the Llagas Groundwater Subbasin	The District operates its water supply system in a manner that is consistent with the treated water contracts and maintains water deliveries to Upper Llagas Subbasin recharge facilities. However, it is important to Llagas Subbasin retailers to have certainty regarding operations.
Increase/tier agricultural groundwater charges	This would not significantly increase revenue, but could be an effective tool for managing groundwater production. This option would require a policy shift by the District Board of Directors. The Executive Committee noted that analysis needs to be done to quantitatively estimate potential water savings.
Expand urban conservation	Urban conservation has a proven track record of reducing demands at a relatively low cost, is energy efficient, and does not have significant adverse impacts.
Mandatory recycling for large commercial/industrial developments	This could provide a means of utilizing the South County recycled water system to its full capacity at a low cost.

Water Supply Option	Rationale/Discussion
Options to Analyze Further	
Expand recycling in Gilroy	This would be consistent with the South County Recycled Water Master Plan.
Advanced recycled water treatment	The water could be used to supplement recharge in Morgan Hill or streamflow in Uvas Creek.
Wastewater scalping plant in Morgan Hill	This is an option identified during development of the South County Recycled Water Master Plan for producing additional irrigation water to offset groundwater demands.
New recharge ponds in Morgan Hill, including the use of Morgan Hill's Butterfield Channel during the dry season	Additional groundwater recharge ponds were a recommendation of IWRP 2003.
Intertie between Morgan Hill and Gilroy	The groundwater modeling indicated that moving pumping from Morgan Hill to Gilroy reduces the water supply shortfall. The Planning Team observed that this option needs to be combined with additional pumping capacity.
Other Options for Future or Countywide Consideration	
Surface Water Treatment Plant (25 MGD)	Previous studies have evaluated the need for a surface water treatment plant. All the studies have recommended continuing to rely on the groundwater subbasin until such time that the subbasin no longer provides sufficient reliability. In addition, the Planning Team could not identify additional water sources that could supply a surface water treatment plant.
Wellhead Treatment Capacity	This was an option considered by IRWP 2003, which concluded that wellhead treatment would be less expensive than a surface water treatment plant should groundwater quality become an issue. Morgan Hill has installed wellhead treatment as needed.
Groundwater extraction along the Pajaro River	The average outflow from the Llagas Groundwater Subbasin to the Bolsa Subbasin is about 2,500 AFY. However, this prevents intrusion of water from the Bolsa Subbasin. Further, as demands in the subbasin increase, outflow may decrease.
Agricultural Conservation	IWRP 2003 identified several options for agricultural conservation. However, the estimated yields compared to the costs were high. There is also uncertainty about their effectiveness because they rely on growers to change operations.
Uvas Reservoir Expansion	This option, as described by IWRP 2003, would include a connection to the District's raw water system. This option seems to be best analyzed in a countywide context.

The Executive Committee also made several general comments regarding the initial list of water supply options, including:

- The final project recommendations should address the need to protect groundwater quality, especially from septic systems and agriculture,
- The costs and benefits of maintaining water levels in agricultural wells needs to be evaluated,
- The Planning Team needs to return to the Executive Committee with more details on the impacts to groundwater and water supply and the costs of implementing the recommended actions, and
- Implementing the recommended actions needs to be considered the "new" baseline condition.

4.2 Benefit and Cost Analysis

District staff developed capacity and cost estimates for most of the options in the "recommended" and "analyze further" categories. The various water supply options ranged in capacity from 325 AFY to 7,000 AFY. Costs ranged from no direct cost to an annualized cost of $1,600 per AF. The Planning Team also identified how the options contributed to planning objectives. The results of the analysis are summarized in Table 4 - 2 and detailed in Appendix A.

Staff did not evaluate costs and benefits for three of the recommended actions in Table 4 - 1. Staff did not further evaluate expanded urban conservation (above the planned level of about 4,100 AFY by 2030) because District water conservation staff was unable to identify significant opportunities to expand urban conservation beyond the planned levels. Staff was unable to quantify two other alternatives – increase/tier agricultural groundwater charges and mandatory recycling. Mandatory recycling was not quantified because of uncertainty with recycled water system capacity and a lack of examples of how this could be implemented. City of Gilroy and District staffs coordinate on new development to, among other things, determine if recycled water use requirements are appropriate. Increasing/tiering agricultural groundwater charges was not evaluated because 1) the District Act limits agricultural groundwater production charges and 2) staff was unable to quantify potential changes in water use as a result of modest changes in water charges.

Table 4 - 2: Summary of Water Supply Option Benefits and Costs[1]

Water Supply Option	Capacity (AFY)	Planning Objectives/Sub-Objectives: Redundancy	Protect Groundwater Quality	Meet or Exceed Water Quality Regulations	Provide Community and Environmental Benefits	Annualized Cost/AF
Agricultural conservation - Irrigation Efficiency Program	325		•			$415
Agricultural conservation – Periodic land fallowing	2,100		•			$1,000
Recycling - Advanced treatment at SCRWA plant and delivery to Morgan Hill area for recharge	4,020	•		•	•	$896
Recycling – Implement South County Recycled Water Master Plan Long-term CIP and add users on South Pipeline	900	•		•	•	$533
Recycling - Scalping plant in Morgan Hill to produce irrigation water	500	•		•	•	$1,600
Reconsider the groundwater elevation target[2]	7,000					$4
Potable water system intertie between Morgan Hill and Gilroy	4,000	•				$275
Ensure minimum South County deliveries for recharge[2]	5,000					$0
Recharge - Additional ponds at Main Avenue	1,350		•		•	$296
Recharge – Extend Madrone Pipeline and use Butterfield Channel for recharge	4,020		•			$75
Recharge - Repair Madrone Pipeline[2,3]	2,000		•			$100
Recharge - Increase operational capacity at San Pedro Ponds & Tennant Creek (Upper)	1,460		•		•	$1,370
Recharge - Upper Madrone Dams	1,650		•			$121
Package Surface Water Treatment Plant	4,000	•				$350

[1] Detailed information on the estimates in this Table are provided in Appendix A.

[2] Recommended for implementation by the project Planning Team

[3] The recommendation by the project Planning Team in Table 4-1 is to repair/replace both Main and Madrone Pipelines. Only Madrone Pipeline repair is listed here because Main Avenue Pipeline restoration was added to the District's CIP in the interim.

5. Portfolio Construction and Evaluation

This phase of planning process involved updating the estimated water supply shortfall based on the "new baseline" that includes implementing the recommended actions, developing portfolios of projects to address the remaining water supply shortfall, evaluating how well those portfolios achieve planning objectives, and evaluating groundwater conditions with different portfolios.

5.1 Updated Water Supply Shortfall Estimate

The initial estimated water supply shortfall, as discussed in Chapter 3, was 16,000 AFY. The Planning Team identified several water supply options that should be implemented and the Executive Committee recommended including those projects as part of the "new baseline." District staff was able to develop capacity and cost estimates for three of those options – reconsidering the groundwater elevation target, prioritizing deliveries of water for recharge to South County, and repairing Madrone Pipeline. As noted in Section 3.4, lowering the minimum groundwater elevation target could reduce the shortfall by up to 7,000 AFY and prioritizing South County deliveries could further reduce the shortfall by up to 5,000 AFY. Combined, these two actions would reduce the shortfall by 12,000 AFY to about 4,000 AFY. Staff estimated that repairing Madrone Pipeline would provide about 2,000 AFY in water supply benefits and further reduce the shortfall to about 2,000 AFY.

5.2 Initial Portfolio Development

Staff reviewed the water supply alternatives described in Chapter 4 and developed seven initial portfolios designed to provide at least 4,000 AFY of water supply benefit. The portfolios are designed to provide 4,000 AFY of water supply benefit because they all include prioritized deliveries of water to South County and a lower groundwater elevation target, but they do not all include Madrone Pipeline Repair. Madrone Pipeline repair, which provides about 2,000 AFY in water supply benefits, was included in five of the seven portfolios. The initial portfolios are summarized in Table 5 - 1.

5.3 Initial Portfolio Evaluation

The Planning Team evaluated the different portfolios against the planning objectives. Each portfolio was scored on a scale of 0 to 100, with 100 being the highest score, for each planning sub-objective. Each planning sub-objective was weighted according with the percentages described in Section 2. The results of the scoring are illustrated in Figure 5 - 1. The top three scoring portfolios were Gilroy Recycling, Advanced Recycled Water Treatment, and Morgan Hill Recycling. All three portfolios scored well on reliability, which is the most heavily weighted planning objective. The Gilroy and Morgan Hill Recycled Water options scored better on cost and the Advanced Recycled Water Treatment scored better on water quality. The Recharge portfolio scored best on cost and environmental and community benefits and scored better than

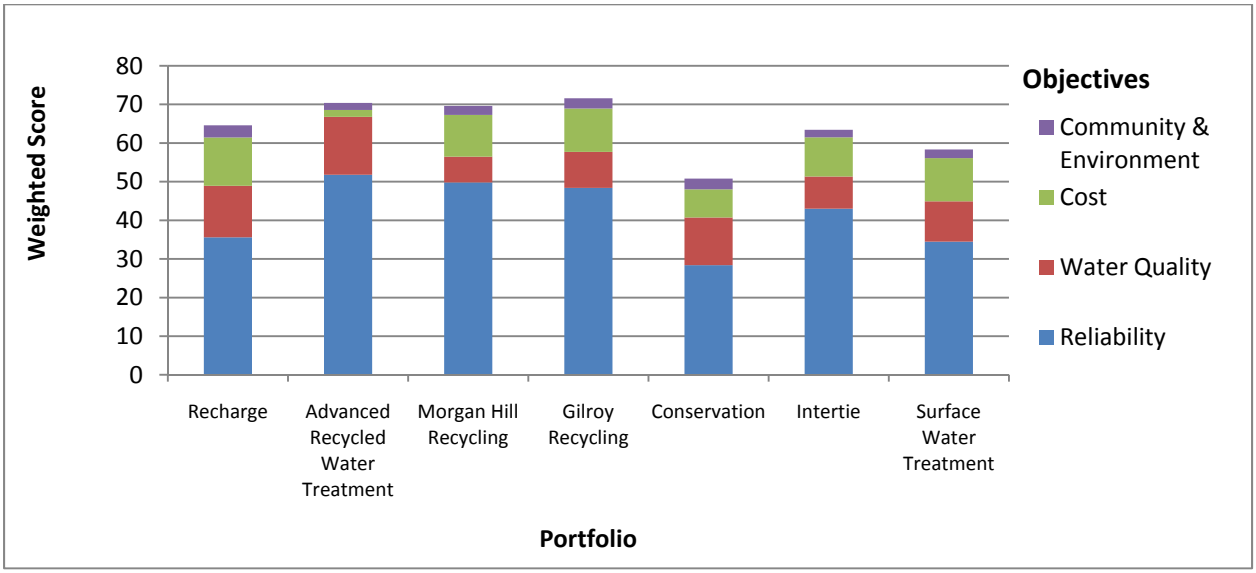
Gilroy and Morgan Hill Recycled Water portfolios on water quality. However, it did not score as well on reliability as the top three scoring portfolios since it is dependent on having a reliable source of water.

Table 5 - 1: Initial Portfolios

Portfolio	Capacity (AFY)	Annual Cost per AF ($/AF)	Comments
Recharge • Improve Madrone Pipeline • Recharge in Butterfield Channel	6,020	$83	Provides water quality benefits because recharge water is low in nitrate and TDS. Relatively low impact on the environment. Potentially limited availability of water in dry years. Potential to increase recharge capacity in excess of operational groundwater storage capacity in the Morgan Hill area.
Advanced Recycled Water • Advanced recycled water treatment in Gilroy and delivery to Morgan Hill • Improve Madrone Pipeline • Recharge in Butterfield Channel	4,020	$1,020	Costs could be reduced by reducing the capacity or, perhaps, siting a smaller facility in Morgan Hill. All-weather supply that would dramatically increase the reliability and quantity of recharge water supply in the Morgan Hill area. Water would be very high quality. Significant potential implementation issues, including regulations and brine disposal. More infrastructure and energy intensive than other portfolios. Capacity could increase if blending requirements are relaxed.
Morgan Hill Recycling • Scalping plant in Morgan Hill for irrigation water • Improve Madrone Pipeline • Recharge in Upper Madrone Channel	4,150	$289	All-weather supply. Reduces demands in the Morgan Hill area. Potential for adverse groundwater quality impacts, low customer demand, and adverse impacts on treatment processes at the SCRWA treatment plant.
Gilroy Recycling • Long-term CIP from South County Recycled Water Master Plan • Recycled water use on South Pipeline • Improve Madrone Pipeline • Recharge in Upper Madrone Channel	4,550	$198	All-weather supply and reduces demands in the Gilroy area. Low potential for adverse groundwater quality impacts because most customers are in the confined area of the groundwater basin and recycled water is low in nitrate.

Portfolio	Capacity (AFY)	Annual Cost per AF ($/AF)	Comments
Agricultural Conservation • Irrigation efficiency program • Agricultural land fallowing • Improve Madrone Pipeline	4,425	$550	Implementation is uncertain since it would depend on finding growers willing to participate in the program. Also, fallowing land may be inconsistent with County policies for maintaining agricultural lands in production and inconsistent with maintaining the viability of an agricultural economy in general.
Intertie • Potable water system intertie between Morgan Hill and Gilroy	4,000	$275	Not as infrastructure intensive as advanced recycled water treatment. May provide more efficient use of groundwater subbasin. Adds backup/redundancy to system. Provides no new water and would only be used in dry years. May not maintain groundwater levels.
Surface Water Treatment • "Package" surface water treatment plant to serve Morgan Hill	4,000	$350	Maximizes conjunctive use of the groundwater basin by providing an alternative delivery system when the groundwater subbasin is "full" and additional recharge would not be put to beneficial use. Provides a high-quality water supply for blending or replacement water if groundwater contamination is an issue. Potential concern with the availability of water supply, though staff anticipates that a South County treatment plant would have similar water supply reliability as a North County plant.

Figure 5 - 1: Initial Portfolio Scores



The Planning Team performed a more qualitative ranking of the portfolios after reviewing the results of the scoring. The results of the qualitative ranking, in decreasing order of preference, were:

1. Gilroy Recycling
2. Morgan Hill Recycling
3. Intertie
4. Recharge
5. Advanced Recycled Water Treatment
6. Agricultural Conservation
7. Surface Water Treatment

5.4 Portfolio Evaluation with Modeling

Several of the portfolios were further analyzed with the District's system model (SYSMOD) and/or groundwater model. Modeling assumptions for this evaluation were updated to include using Main Avenue Pipeline, since the Main Avenue Pipeline Restoration project had been added to the District's CIP.

SYSMOD Comparison of Recharge and Morgan Hill Recycling Portfolios

District staff utilized SYSMOD to compare the Recharge portfolio with the Morgan Hill Recycling portfolio. In both scenarios, deliveries to South County for recharge were equal in priority to deliveries to the water treatment plants in North County. The recycling and recharge portfolios performed about the same with regard to changes in groundwater storage at the end of a 30-year hydrologic period, even though the recharge portfolio included 6,000 AFY of "capacity" and the recycling portfolio included 4,000 AFY of "capacity". In the model, deliveries to the Upper Llagas recharge facilities were lower than long-term average deliveries and there was

insufficient water in dry years to utilize all the recharge capacity. Real operations would not be as constrained in deliveries to South County as the model. Nonetheless, limited dry-year water supplies, as well as limited groundwater storage that is observed in the Morgan Hill area, would indicate a preference for all-weather supplies such as recycling.

Groundwater Model Analysis of Recharge, Surface Water Treatment, and Morgan Hill Recycling Portfolios

District staff built on the prior SYSMOD analysis and utilized the District's groundwater model to compare groundwater conditions with the Recharge and Morgan Hill Recycling portfolios, as well as the Surface Water Treatment portfolio. The Surface Water Treatment portfolio was analyzed to evaluate whether it provided significant groundwater management benefits, i.e., less subsurface outflow from the groundwater subbasin, compared to the recharge alternative. In this modeling analysis, South County deliveries for recharge were prioritized above deliveries to North County treatment plants to better reflect deliveries in actual operations. In addition, the modeling inputs were revised to include 170 AFY of recycled water use in southern Gilroy along SCRWA's South Pipeline. The other change was to refine the estimate for recharge capacity in the Butterfield Channel from 4,020 AFY to 3,765 AFY based on a more detailed review of recharge capacities. A capacity of 3,765 AFY was also used for Surface Water Treatment so that recharge and surface water treatment could be compared. In summary, the following four scenarios were compared in the District's groundwater model:

- Baseline Case: South County deliveries are prioritized to reflect actual operations, addition of 170 AFY of recycling in Gilroy, and Main and Madrone Pipelines are restored
- Portfolio 1 – Recharge: Baseline Case plus Madrone Pipeline is extended to Butterfield Channel, which is used to recharge 3,765 AFY
- Portfolio 2 – Surface Water Treatment: Baseline Case plus 3,765 AFY of surface water treatment in the Morgan Hill area
- Portfolio 3 – Morgan Hill Recycling: Baseline Case plus 500 AFY of recycling in Morgan Hill

The groundwater model simulated groundwater conditions over a 30-year period using historic hydrology from 1967 through 1996 and estimated demands for 2030 to evaluate whether any of the four scenarios will adequately meet demands without causing adverse impacts to the Llagas Groundwater Subbasin. The modeling results were evaluated using different types of measures, including change in groundwater storage, simulated groundwater elevations, significant drawdown in wells, and groundwater flow exchange between the Llagas Subbasin and the Bolsa Subbasin in San Benito County.

One of the measures the District tracks is simulated groundwater elevations, which are compared to historic groundwater conditions at various times. Prior to this water supply planning project and during the baseline water supply outlook performed for this project, the District's groundwater elevation target was to maintain groundwater elevations above 1987 conditions. Concurrent with this water supply planning project, the District reconsidered its

groundwater elevation target. As a result, the current estimate is that the September 1990 elevation is the minimum groundwater elevation that needs to be maintained in order to avoid adverse conditions and minimize inter-basin groundwater flow between the Llagas and Bolsa Subbasins. Modeled groundwater elevations for the different portfolios are illustrated in Appendix B.

The groundwater modeling results indicate that all three portfolios maintain groundwater elevations above September 1990 levels in the Morgan Hill and San Martin areas. However, none of the portfolios maintain groundwater elevations in the Gilroy area above September 1990 levels and inflow from the Bolsa Subbasin is expected to occur during droughts.

Table 5 - 2: Groundwater Modeling Results Summary

	Baseline Case	Portfolio 1 – Recharge	Portfolio 2 – Surface Water Treatment	Portfolio 3 – Morgan Hill Recycling
Cumulative change in groundwater storage	9,000 AF	29,000 AF	29,000 AF	20,000 AF
Simulated water levels in Morgan Hill	Falls below September 1990 level for three years and briefly reaches lowest 1977 level	Well above September 1990 level during entire simulation period.	Well above September 1990 level during entire simulation period.	Well above September 1990 level during entire simulation period.
Simulated water levels in San Martin	Majority of simulation period stays above September 1990 level.	Well above September 1990 level during entire simulation period.	Well above September 1990 level during entire simulation period.	Above September 1990 level during entire simulation period.
Simulated water levels in Gilroy	Below September 1990 for significant portion of 2027 to 2033 period.	Below September 1990 for significant portion of 2027 to 2033 period.	Below September 1990 for significant portion of 2027 to 2033 period.	Below September 1990 for significant portion of 2027 to 2033 period.
Significant drawdown in wells and shallow wells may go dry	Significant drawdown in wells along the along eastern and western borders appears around 2015. By 2029, the area along the eastern border with significant drawdown expands considerably.	Significant drawdown do not appear until 2029 and the area is much smaller in size compared to the baseline scenario	Expected to be similar to Portfolio 1.	Expected to be similar to Baseline Case but with smaller areas of significant drawdown.
Groundwater flow exchange between the Llagas and Bolsa	Increase in groundwater flow from Bolsa Subbasin starting from 2011 with average net inflow from Bolsa Subbasin of 1,400 AFY	Increase in groundwater flow from Bolsa Subbasin starting from 2011 with average net inflow from Bolsa	Expected similar groundwater flow pattern as Portfolio 1	Increase in groundwater flow from Bolsa Subbasin starting from 2011 with average net inflow from Bolsa

Subbasins	during the simulation period.	Subbasin of 700 AFY during simulation period.	Subbasin of 1,200 AFY during the simulation period.

Significant water level decline is predicted during drought conditions. The additional recharge or demand offset proposed in all the portfolios appear to mitigate water level decline in the Morgan Hill area, but have relatively small water level improvements in the Gilroy area. It should be noted that the portfolios were designed to address water supply needs in the Morgan Hill area, based on findings in the baseline water supply outlook that the Morgan Hill area seemed more susceptible to water supply shortfalls and the Gilroy area seem more resilient. However, additional water supplies or demand offset, above those included in the portfolios, appear necessary to maintain groundwater elevations and minimize subbasin exchange with Bolsa Subbasin in the Gilroy area.

The groundwater modeling results indicate that recharge (Portfolio 1) and surface water treatment (Portfolio 2) perform similarly with respect to groundwater conditions. There is some advantage to groundwater conditions with the water treatment plant because it results in less subsurface flow that leaves the subbasin. Both portfolios perform well with regard to water levels in the Morgan Hill and San Martin areas and, with additional supplies or demand offsets, may be sufficient to minimize subbasin exchange in the Gilroy area.

5.5 Portfolio Analysis Summary

Several alternative water supply portfolios were developed and evaluated through both qualitative and quantitative means. City and County staff stated a preference for recharge and recycling, which scored and ranked well against planning objectives. These water supply alternatives are consistent with prior water supply planning studies. The Planning Team also believes that recharge with advanced treated recycled water is a potential future water supply option that warrants continued consideration.

The other water supply portfolios are not recommended for further evaluation or implementation. As in prior planning studies, the potential conjunctive use benefits of surface water treatment were outweighed by the costs and risks associated with surface water treatment. The cities concluded that an intertie is not a water supply option, though an emergency intertie might be something they consider if their service areas are closer in the future. Reduced agricultural water use is of interest, since agriculture accounts for about half the groundwater use in South County, but the Planning Team did not feel that the agricultural water conservation portfolio was technically or economically feasible. In addition, agricultural land fallowing, part of the agricultural water conservation portfolio, is inconsistent with County policies and preserving the vitality of South County's agricultural economy.

Groundwater modeling indicates that additional groundwater recharge in the Morgan Hill area would be sufficient to maintain groundwater levels in the Morgan Hill and San Martin areas, but

additional water supplies would be needed to maintain groundwater levels in Gilroy and minimize subbasin exchange.

6. Findings and Recommendations

This section reiterates the key findings and presents recommendations developed as part of this project. As noted in the Introduction, a preferred portfolio was not selected through this planning project. At the same time the South County Water Supply Planning Project was evaluating water supply options for the Llagas Groundwater Subbasin, the District decided to initiate a countywide Water Supply and Infrastructure Master Plan (WSIMP) project. Rather than complete a separate Master Plan for South County, the District will incorporate the South County Water Supply Planning project work into the WSIMP.

Several of the South County Water Supply Planning project objectives were achieved. Specifically, water supply options for meeting future demands in the Llagas Groundwater Subbasin were evaluated, the Planning Team's working relationship improved communication and coordination on land use and water supply planning, and water supply options that optimize existing systems were evaluated. Other planning objectives, most of which were related to implementation planning, were not achieved. However, the District plans to achieve them through the WSIMP. The exception is the objective to evaluate whether additional groundwater quality management activities are necessary, which is discussed below in recommendations.

The key findings and recommendations from the South County Water Supply Planning project are presented below.

6.1 Key Findings

Different sections of this report include specific findings. The key findings are listed below.

1. **Groundwater demands in the Llagas Groundwater Subbasin are expected to increase.**

   Groundwater demands in the Llagas Groundwater Subbasin are anticipated to increase by about 7,000 AFY from about 44,000 AFY in 2001 to about 51,000 AFY in 2030. The estimated increase in demands is due to growth in the cities. Agricultural and rural water use is anticipated to remain constant. The demand projection includes about 4,100 AFY of additional conservation and 1,900 AFY of additional recycling by 2030.

2. **Additional supplies are needed to meet future demands.**

   Staff anticipates a water supply shortfall under 2030 demands ranging from about 4,000 AFY to 16,000 AFY depending on assumptions regarding groundwater management and recharge operations. The 16,000 AFY shortfall is based on assumptions that South County recharge is reduced to meet North County treatment plant demands and groundwater elevation need to be maintained above 1987 groundwater elevations. The 4,000 AFY shortfall is based on assumptions that South County deliveries for recharge are maintained

during water supply shortages and that groundwater elevations down to 1977 drought levels are acceptable.

Groundwater modeling results and updated analysis of the groundwater elevation target indicate that the shortfall is on the lower end of shortfall range. However, more than 4,000 AFY of additional supplies are needed to meet future water demands.

3. **Water shortfalls are more pronounced in the Morgan Hill area.**

   The Morgan Hill area is very dependent on managed groundwater recharge and the location of pumping affects water levels. Staff concludes that this is due to limited groundwater inflows at the northern end of the groundwater subbasin and the smaller "volume" of the subbasin in the area. Reductions in or cessation of recharge has significant impacts on groundwater levels. Groundwater conditions in San Martin and Gilroy are more resilient to changes in recharge.

4. **Actual groundwater recharge operations for the Llagas Groundwater Subbasin are not accurately reflected in the District's SYSMOD system model.**

   The District's SYSMOD system model prioritizes raw water deliveries to treatment plants over deliveries for recharge. This approach is consistent with the District's treated water contracts with retailers, which call for the District to reduce other deliveries before reducing contract deliveries. However, South County deliveries for recharge are often reduced more in modeling scenarios than they would be in actual operations. This results in overestimating potential water supply shortfalls.

   The District has updated its system model since the analysis for this planning project was completed. The District transitioned from SYSMOD to a model called WEAP. In WEAP, District staff is able to differentiate between contract and non-contract treated water demands in the model and to discontinue non-contract treated water deliveries in dry years. This has improved the accuracy of the model in reflecting actual raw water deliveries, though actual deliveries to South County may still exceed modeled deliveries.

5. **Groundwater elevations should be maintained at levels above 1990 levels to avoid adverse groundwater impacts.**

   In a parallel effort to the South County Water Supply Planning project, the District evaluated minimum groundwater elevations needed to avoid adverse impacts in the Llagas Groundwater Subbasin. District staff estimates that maintaining groundwater elevations above those that occurred in September 1990 will minimize subbasin exchange between the Llagas and Bolsa Subbasins and avoid significant drawdown in wells.

6. **A small surface water treatment plant servicing the Morgan Hill area does not offer significant groundwater management benefits compared to additional groundwater recharge.**

   Surface water treatment results in less subsurface flow that leaves the subbasin. However, recharge and surface water treatment perform similarly in other groundwater conditions measures such as groundwater elevations and change in storage.

7. **Staff from the cities and County recommend additional groundwater recharge and recycling as the means to meet additional water supply needs.**

   Recycling and recharge were the highest scoring portfolios and, since a potable water system intertie was not determined to be a viable water supply option, highest ranked portfolios. All the recycled water options scored well for reliability. Different recycled water options performed differently against the other planning objectives. Recharge scored well for water quality, cost, and community and environmental benefits.

6.2 Recommendations

District staff developed the following recommendations in conjunction with staff from the other agencies in the Planning Team:

1. **Repair or replace Madrone Pipeline.**

   Madrone Pipeline is an existing asset and its continued operation is vital to the Llagas Groundwater Subbasin. Repairing or placing the pipeline increases the District's ability to make use of existing recharge capacity, providing about 2,000 AFY in water supply benefits. In addition, repairing or replacing Madrone Pipeline enables future extension of the pipeline to Morgan Hill's Butterfield Channel and/or extending the pipeline north to increase utilization of the northernmost part of Madrone Channel for groundwater recharge.

   Madrone Pipeline repair or replacement has been added to the Main Avenue Pipeline Restoration project in the District's CIP. The Main Avenue and Madrone Pipelines Restoration Project planning phase should be complete by August 2010 and design is scheduled for completion in 2011.

2. **Implement a lower groundwater elevation target for the Llagas Groundwater Subbasin.**

   The District managed the Llagas subbasin to maintain groundwater elevations above 1987 conditions prior to this project. During the project, District staff reviewed the groundwater elevation target and currently estimates that maintaining groundwater elevations above September 1990 levels will minimize groundwater subbasin exchange with the Bolsa

Subbasin and avoid significant drawdown in wells. In other words, a minimum groundwater elevation target of September 1990 levels meets groundwater management objectives.

3. **Document and communicate the District's South County operations plan.**

   The District's treated water contracts with retailers in North County specify that the District will reduce or suspend recharge before reducing treated water contract deliveries in times of water supply shortages. District models reflect this operation. As noted previously, this approach overestimates the water supply shortfall in the Llagas Subbasins. In practice, the District currently operates its water supply system in a manner that enables it to meet both treated water contract demands of about 120,000 AFY and Upper Llagas recharge demands of about 10,000 AFY on average. The South County retailers would like the District to formalize its planned operations so the retailers can better understand District operational targets under different scenarios and have more certainty in anticipated deliveries. Better documentation will also assist future water supply planning efforts, including the District's Water Supply and Infrastructure Master Plan.

4. **Explore and, as appropriate, develop recycled water options, including recycled water options for Morgan Hill.**

   The District, South County Regional Wastewater Authority (SCRWA), Gilroy, and Morgan Hill partnered to develop the South County Recycled Water Master Plan Report in 2004. The purpose of the Master Plan Report is to expand recycled water use to increase water supply reliability and reduce demands on the groundwater. Recycled water use also provides wastewater management benefits by reducing the volume of effluent requiring disposal. The Recycled Water Master Plan Report recommended three phases of capital improvement projects that would expand recycled water use in the Gilroy area. The first (immediate-term) phase of projects has been completed. The District is in the process of implementing the second (short-term) phase of projects and this South County Water Supply Planning project assumed the recycled water delivery projections for the short-term projects are achieved. This project did not assume the third (long-term) phase of recycled water projects would be completed since the projects are not included in the District CIP and some of the assumptions about future users may no longer be accurate.

   The District should work with SCRWA and the cities to develop recycled water options to consider in the District's Water Supply and Infrastructure Master Plan. These options could include implementing some or all of the long-term capital improvement projects in the South County Recycled Water Master Plan, producing and using recycled water for irrigation and non-potable uses in Morgan Hill, and producing and using advanced treated recycled water in Morgan Hill for recharge. Future updates of the South County Recycled Water Master Plan should be consistent with the District's Water Supply and Infrastructure Master Plan and wastewater management needs in South County.

One recycled water option that the District should consider now is partnering with SCRWA to install turnouts on SCRWA's South Pipeline. The pipeline routing will be through agricultural land and some growers have expressed interest in using recycled water. This project made a conservative estimate of about 170 AFY of recycled water demand along the South Pipeline, assuming use by one additional grower using recycled water at the same level per acre as the current agricultural customer. The District should confirm the market potential and turnout costs and decide whether to install turnouts along the pipeline during pipeline construction.

5. **Consider Morgan Hill's Butterfield Channel in future water supply planning efforts.**

   The City of Morgan Hill owns and operates Butterfield Channel for stormwater management and City staff reports that the channel has good recharge capacity. This project identified the need for additional water supplies and the cities and County expressed their preference that those additional water supplies consist of recharge and recycling. The system and groundwater modeling performed for this project indicated that extending the Madrone Pipeline to Butterfield Channel and using the channel for recharge during the summer would be sufficient to meet future water supply needs in the Morgan Hill area.

   If, through the District's Water Supply and Infrastructure Master Plan, the District determines that it can provide a reliable source of water for additional recharge in the Llagas Subbasin, Morgan Hill's Butterfield Channel presents an opportunity to increase recharge capacity in the Upper Llagas Groundwater Subbasin without having to purchase land. The District would need to negotiate access, conduct field investigations, and enter into operating agreements with the City prior to implementing a project involving Butterfield Channel.

6. **Focus on groundwater recharge and recycling in future water supply planning efforts.**

   The Cities and County prefer recharge and recycling as water supply alternatives for South County, and recharge and recycling were the highest scoring portfolios in this planning project. Nonetheless, it is important that these options also be evaluated in a countywide context during development of the Water Supply and Infrastructure Master Plan. The current sources of supply for recharge are shared between North County and South County and there may be opportunities for sharing recycled water resources between the two areas.

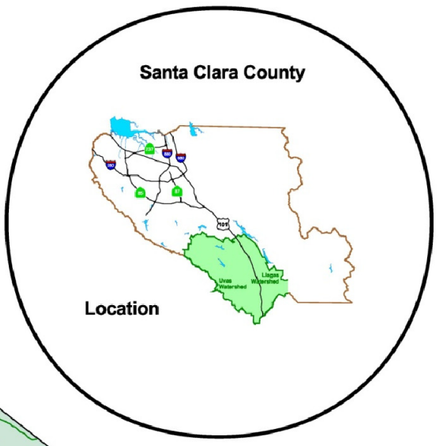
7. **Continue groundwater quality protection efforts.**

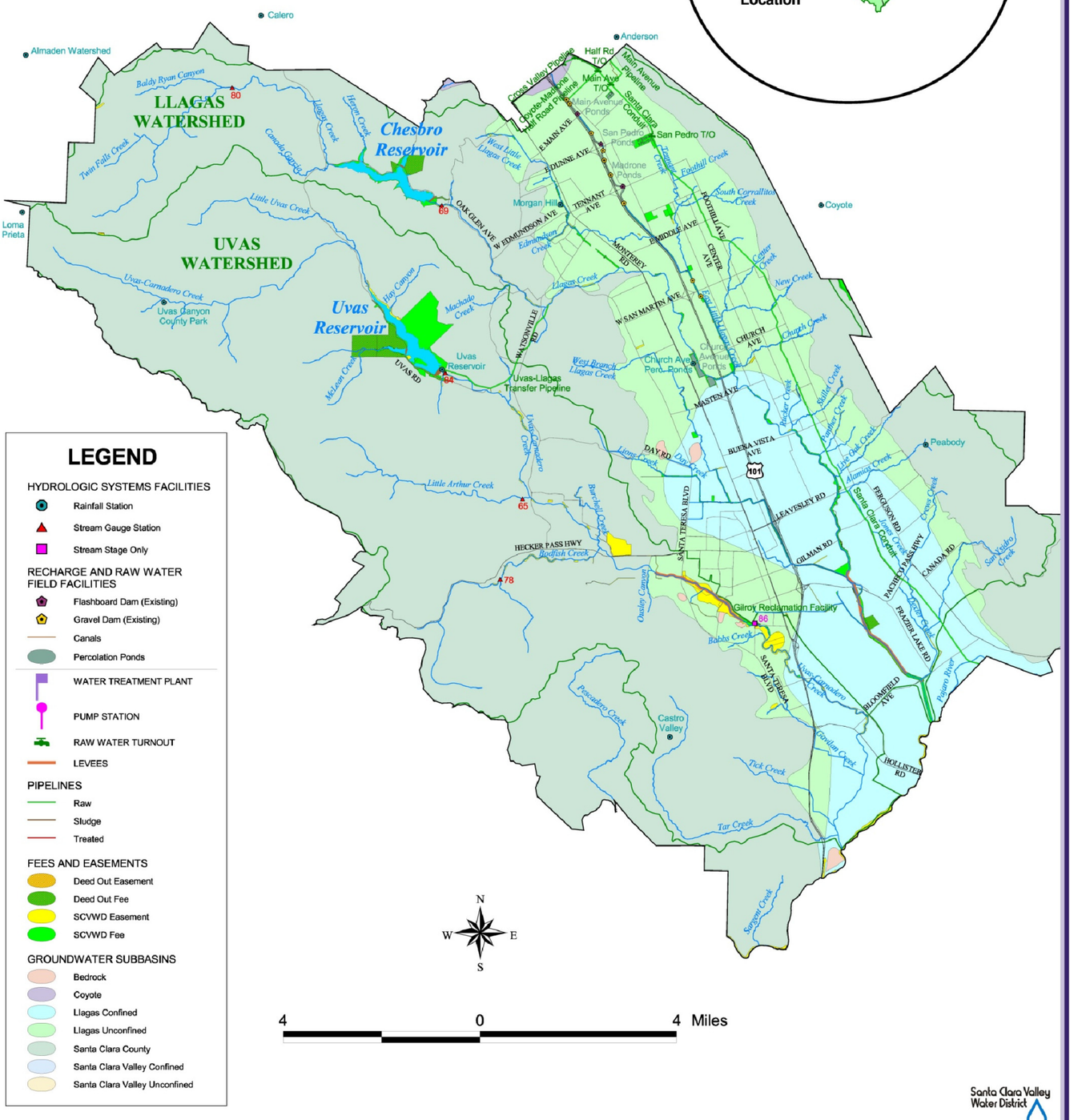
   Nitrate contamination, primarily from agriculture and rural land use practices, is an ongoing groundwater quality issue in the Llagas Groundwater Subbasin. Perchlorate from a former manufacturing facility in Morgan Hill is also a concern. While the Central Coast Regional Water Quality Control Board and, to a lesser extent the County, are responsible for regulating different water quality issues, the District's efforts in identifying and implementing groundwater protection programs are also important for preventing groundwater quality degradation. Protecting groundwater quality minimizes water supply risks. This work is

typically accomplished through the District's ongoing water supply operations rather than long-term planning projects. It should be noted that the District's recharge operations help reduce concentrations of some contaminants, including nitrate and perchlorate, in groundwater.

The WSIMP project is currently underway and is scheduled to be completed in August 2012. The WSIMP will include an implementation plan with a schedule and financial plan. In addition, the District plans to prepare an Environmental Impact Report for the WSIMP. The County, Morgan Hill, Gilroy, and SCRWA have been invited to participate in the project's Stakeholder Review Committee. The District will keep all stakeholders informed about the project. In addition, this report will help inform the WSIMP staff of the South County agency's interests and needs.

Uvas and Llagas Watersheds





LEGEND

HYDROLOGIC SYSTEMS FACILITIES
- Rainfall Station
- Stream Gauge Station
- Stream Stage Only

RECHARGE AND RAW WATER FIELD FACILITIES
- Flashboard Dam (Existing)
- Gravel Dam (Existing)
- Canals
- Percolation Ponds
- WATER TREATMENT PLANT
- PUMP STATION
- RAW WATER TURNOUT
- LEVEES

PIPELINES
- Raw
- Sludge
- Treated

FEES AND EASEMENTS
- Deed Out Easement
- Deed Out Fee
- SCVWD Easement
- SCVWD Fee

GROUNDWATER SUBBASINS
- Bedrock
- Coyote
- Llagas Confined
- Llagas Unconfined
- Santa Clara County
- Santa Clara Valley Confined
- Santa Clara Valley Unconfined

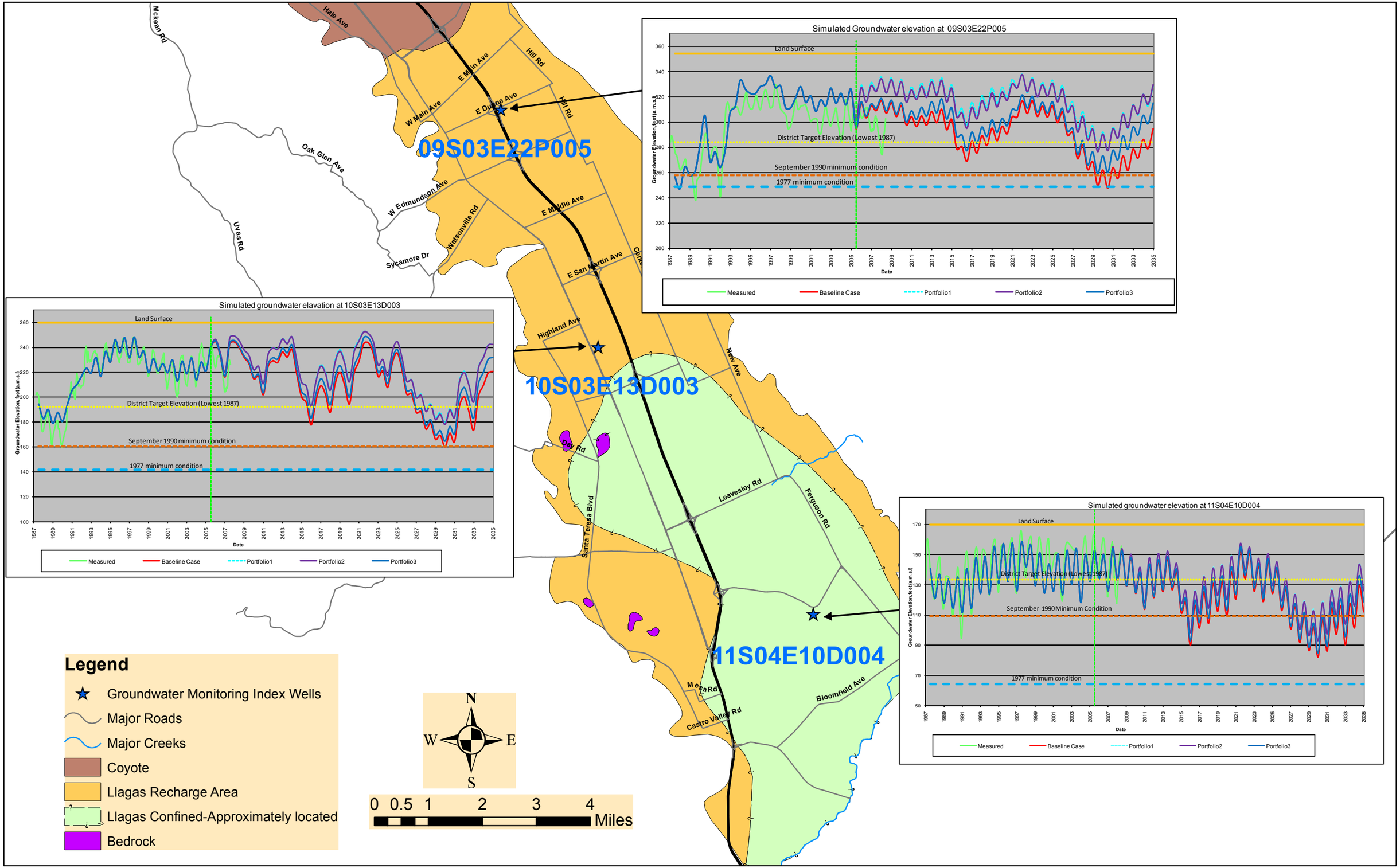
Santa Clara Valley Water District

927607/2002_120/small_watershed_maps/Uvas-Llagas_Watershed Map 4/29/2002

Water Supply Alternatives

Alternative	Capacity (AFY)	Capital Cost	Annual Cost	Annualized Cost/AF	Description	Comments
Ag conservation - Irrigation Efficiency Program	325	$ -	$135,000	$415	Irrigation management assistance to improve irrigation efficiency. Includes irrigation system evaluations, metering and monitoring fields, and technical assistance.	• Uncertain yield • Assumes growers maintain high irrigation efficiency over time • Uncertain participation • Improved irrigation management should reduce leaching of chemicals to groundwater • Cost developed based on draft agreement with Farm Bureau. • Ramp up from 10 growers in first 3 years.
Ag conservation - Land fallowing	2100	$10,500,000	$2,100,000	$1,000	Growers refrain from irrigation up to 30% of valley lands in any year at the request of SCVWD, providing in lieu recharge. Land taken out of production is maintained in accordance with approved soil and water management plans, and rotated once every one to five years. Annual payments to farmers for land maintenance in proportion to actual acreage fallowed. Based on Palo Verde/MWD Program.	• Uncertain participation level • Inconsistent County policies for maintaining high value ag lands • Could be managed as part of a Habitat Conservation Plan • Open space conservation • Could manage land to increase recharge capacity
Recycling - Advanced treatment and delivery to Morgan Hill	4020	$49,000,000	$3,600,000	$896	Advanced treatment would occur in Gilroy to take advantage of MBR and UV at the SCRWA; water would be delivered through a new pipeline from SCRWA to Morgan Hill; water would be used for recharge in Morgan Hill's Butterfield Channel; does not include brine disposal costs	• Brine disposal associated with advanced treatment would contribute significant costs. • California Department of Public Health (DPH) requires include 6-mo time of travel between recharge location and nearest well and/or 500' separation. Adequate separation does not exist at existing recharge facilities. • New, all-weather local supply, except current draft regulations require a 50% blend with surface water for a least the first year. This would necessitate a connection with Madrone Pipeline and Madrone Pipeline repair. • Cost estimate based on 2007 estimate for CVSP; does not include land acquisition for DPH setback requirements or brine management. • Costs may be shared with Morgan Hill and/or SCRWA
Recycling - Gilroy	899	$6,050,000	$479,000	$533	648 AFY from Master Plan Long Term CIP + South Pipeline (167 AFY)	• Need to be sure to model offset in demand in correct locations • South Pipeline yield based on Obata use
Recycling - Scalping plant in Morgan Hill	500	$8,000,000	$800,000	$1,600	0.5 MGD scalping plant would serve golf course and potentially nearby irrigation customers	• Cost estimated based on 2006 District estimate 1 MGD scalping plant; doesn't include pipeline extensions, etc
Lower GW Management Objective	7000	$750,000	$30,000	$4	7,000 AFY is approximate difference in pumping levels between keeping elevations above 1987 levels (40,000 AFY pumping) and 1977 levels (estimated at about 47,000 AFY) based on October 2007 modeling. Modeling assumptions included prioritized south county recharge.	• Preliminary modeling results indicated that only a handful of wells would be screened soley in areas that could go dry, though minimum water levels in remaining wells could be about 55 feet lower if/when groundwater levels drop to a lower "threshold." • The District's GW Management Unit is reviewing operation storage and evaluating minimum groundwater conditions to avoid inducing flow of higher salinity groundwater from San Benito County. Preliminary analysis indicates that minimum condition would be closer to 1977 levels (140 feet above msl in the Llagas index well). The current target is set at the condition when the District took over operations in 1987 (192.3 feet above msl). • Cost estimate is for replacing 5 wells on fringes of groundwater basin at a cost of $100,000 per well; additional costs include increasing electrical costs for pumping all wells if/when groundwater conditions drop below the current target of 192.3 feet msl. • Any estimates herein are for project planning purposes only.

Alternative	Capacity (AFY)	Capital Cost	Annual Cost	Annualized Cost/AF	Description	Comments
Potable water system intertie between Morgan Hill and Gilroy	4,000	$17,800,000	$1,100,000	$275	37,400 foot pipeline from W. Day to Monterey to Tennant Avenue; 5 MGD capacity; this would not be a regular operation, but would be used in extreme conditions.	• Could reduce flows to San Benito County
Ensure minimum South County deliveries	5000	$ -	$ -	$ -	5,000 AFY is the different between pumping levels that would sustain groundwater elevations above 1987 level with (40K AFY - October 2007 analysis) and without (35K AFY - July 2007 initial analysis) prioritizing south county recharge in model.	• There may be costs not yet identified.
Recharge - Additional ponds (at Main Avenue)	1350	$5,800,000	$400,000	$296	6 acres of 4' deep ponds adjacent to Main Ave	• Conservative estimate @ 50% Main Ave recharge rate • Estimated cost based on construction + land purchase
Recharge - Butterfield Channel	4,020	$2,900,000	$300,000	$75	Use of Morgan Hill's Butterfield Channel for recharge during the dry season	• Would need to obtain access to channel from Morgan Hill for field testing and develop institutional arrangements • Dries up at Diana. • Capacity estimate based on Madrone Channel recharge rates
Recharge - Repair Madrone Pipeline	2000	$3,500,000	$200,000	$100	Restores and increases capacity of pipeline to 25 cfs between the Santa Clara Conduit and Madrone Channel; 5 cfs x 1.98 af/d/cfs x 200 days/year = 2,000 AFY	• FEMA compatibility needs to be addressed • Runoff water quality should be considered • Enables capacity for Butterfield @ about 2,000 afy • Assumes federal funding of 55% of project costs, up to $3.9M, available • Cost estimate from District Capital Program staff.
Recharge - Increase operational capacity at San Pedro Ponds & Tennant Creek (Upper)	1,460	$34,300,000	$2,000,000	$1,370	The properties in the area bounded by bounded by San Pedro, Murphy, Barrett, and Hill that are on septic systems could be purchased and retired, so that the ponds and Tennant Creek could be operated without high groundwater constraints. Existing turnout to Tennant Creek.	• Alternatives to land purchase include connecting properties to sewer & stone columns; the feasibility of both options needs to be determined. • Cost estimate based on cost to purchase land south of ponds • 3,000 - 4,000 AFY per Jeff Micko. Need to update yield estimate based on historic recharge in Tennant Creek. • Difference between historic average and conservative ops at San Pedro is 1,460 AFY.
Recharge - Upper Madrone Dams	1650	$2,100,000	$200,000	$121	Extend Madrone Pipeline north to Cochrane Road	• Would include construction of spreader dams
Surface Water Treatment Plant	4000	$15,700,000	$1,400,000	$350	3.6 MGD (2,500 gpm) surface water treatment plant able to take Anderson and/or CVP water in dry years.	• Assume operates 4 out of 10 years.


Mckean Rd
Hale Ave
E Main Ave
Hill Rd
W Main Ave
E Dunne Ave
09S03E22P005
Oak Glen Ave
W Edmundson Ave
E Middle Ave
Watsonville Rd
Uvas Rd
Sycamore Dr
E San Martin Ave
Highland Ave
10S03E13D003
New Ave
Pay Rd
Leavesley Rd
Ferguson Rd
Santa Teresa Blvd
11S04E10D004
Bloomfield Ave
Castro Valley Rd
Simulated Groundwater elevation at 09S03E22P005
Land Surface
District Target Elevation (Lowest 1987)
September 1990 minimum condition
1977 minimum condition
Groundwater Elevation, feet (a.m.s.l)
Date
Measured
Baseline Case
Portfolio1
Portfolio2
Portfolio3
Simulated groundwater elavation at 10S03E13D003
Land Surface
District Target Elevation (Lowest 1987)
September 1990 minimum condition
1977 minimum condition
Groundwater Elevation, feet (a.m.s.l)
Date
Measured
Baseline Case
Portfolio1
Portfolio2
Portfolio3
Simulated groundwater elevation at 11S04E10D004
Land Surface
District Target Elevation (Lowest 1987)
September 1990 Minimum Condition
1977 minimum condition
Groundwater Elevation, feet (a.m.s.l)
Date
Measured
Baseline Case
Portfolio1
Portfolio2
Portfolio3
Legend
Groundwater Monitoring Index Wells
Major Roads
Major Creeks
Coyote
Llagas Recharge Area
Llagas Confined-Approximately located
Bedrock
N
W
E
S
0 0.5 1 2 3 4
Miles